11:00-12:15
1:00-2:15

Week 04 Lecture Notes

What is a literature review?

June 18, 2019

This week

- Abstract final draft due[1]
- Literature reviews

Next week

- Memo/annotated bibliography rough draft due

Attendance

- **Pass attendance sheet around**

Questions about abstract final draft due tonight?

What questions would you like to ask me now about the final drafts that are due tonight?

Has anyone completed them? If so, was everything working okay for you?

Accessing your reviews[2]

Before we get started, I'd like to be sure everyone knows where to find feedback for their rough drafts, so please take a moment to login to eCampus if you haven't already done so.

As you'll learn over the course of the semester, there are a lot of things I really dislike about Turnitin. One of them is that it does not provide me with a student view. In other words, if I were to show you where I find your feedback, it wouldn't be at all helpful because my view is very different from yours.

We have two options, then. The first is that I can just talk you through it, pausing to be sure everyone is seeing what I'm talking about.

The second is for someone to volunteer to login on the console up here for everyone to see.

If someone volunteers, talk them through the process so they get the experience, too, while everyone else sees what they're doing.

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[1] For the writing prompt for this assignment, see http://hdl.handle.net/1969.1/175371

[2] An ongoing issue I've had in using Turnitin is that it's not intuitive for a lot of students how they can access the feedback from their peers or their teaching assistant. Indeed, I've had students make it to the end of semesters in the past without knowing that they were given feedback. Having them access feedback in class helps to mitigate this issue. I'm hopeful that requiring them to write the goals set for them by me or their teaching assistant will take care of the few remaining students who seem to struggle with this task.

If no one volunteers, talk them through the process as usual.

- Peer reviews
- Rachel's review
- Rubric
    - *Note that meeting goals does not guarantee a high grade. It's only one component, but an important one.*

Avery and MacCleod (and McCarty)[3]

I want to begin a little differently today. I'd like all of you to imagine that we're back in 1943.

- No devices
- No computers
- A chalkboard instead of a whiteboard
- Much better fashions

So what's a major thing going on in the world in 1943?

- World War II

You'd most likely be getting news about what was going on in the war from radio broadcasts, newspapers, and news reels before movies.

Now, there were some other nasty things going on as well. For instance, most of you wouldn't be sitting in this class right now due to racial segregation, not to mention that Texas A&M at the time didn't admit women. For that matter, I probably wouldn't have been allowed to teach here. I'm not asking that we romanticize the past or step back into those spaces of social injustice.

Rather, I want to bring us back to this time because you have spent the past 4-5 years of your undergraduate careers learning science. You're fully immersed in it. You eat, drink, and breathe science. Am I right?

No, I'm not!

What you've actually been immersed in, for the most part anyway, is science fact, in science as received wisdom. Unless you've worked in a research lab, science for most of you is a settled thing. These are the facts as we know them.

This is a travesty!

[3] I have a number of purposes in this imaginative exercise. The most immediate goal is help students understand what literature reviews are and what role they play in scientific discourse, both because it's an important concept and because writing a literature review is their capstone project in the class. One of the biggest struggles students face in writing literature reviews is identifying a gap in scientific knowledge. Therefore, one of the reasons I chose this approach was because it frames an unknown in terms of something they're already familiar with. Finally, this approach fits a broader objective I have of helping students understand science as a process for generating knowledge rather than a collection of facts to be memorized.

Show slide with Terry Pratchett quotation

Science is not a collection of facts, but rather a process. It is a method for building better, more useful, more complete understandings of the world.

It is a dynamic process filled with uncertainty and debate and controversy and struggle. It is also a human endeavor fraught with all the drama our species takes with it everywhere it goes. It is in what science doesn't know that the world becomes an enchanted place, filled with mystery and wonder.

I fear that this is something many of you miss out on in your undergraduate careers.

I'm bringing you back to 1943, then, because 75 years ago we didn't know a lot of things about the world that we take for granted now. So I want you to put yourself back into that era, forgetting everything you know today about genetics and molecular biology.

For instance, by 1943 we were pretty familiar with Mendelian genetics.

- We knew about chromosomes
- We knew that hereditary traits were carried on them
- We knew that chromosomes contained both protein and DNA
- We even talked quite a lot about genes

What we didn't know, was what genes were. We had no idea what material substrate carried genetic material.

We were keen, however, to find out!

<u>Enter Avery, MacLeod, and McCarty</u>

Working at the Rockefeller Institute for Medical Research

Avery, MacLeod, and McCarty knew a thing.

Put up PowerPoint slide of R and S strains.

- R strains harmless
- S strains kill
- Heat treated S strains harmless
- Heat treated S strains plus R strains kill

What is it about the S strains that transforms harmless R strains to killer S strains?

That's the great unknown for Avery, MacLeod, and McCarty in 1943.[4]

- What is the transformative material?

[4] At this point I start building a concept map on the whiteboard, starting with a statement of the unknown in a box to the far right of the board and then filling in the initial observation, its replications, and its expansions as separate boxes leading up to the statement of the unknown.

Now, these researchers were not the first to learn of this transformation.

- Griffith is the source for this slide, publishing in 1928, *Journal of Hygiene*
- Neufeld and Levinthal 1928, verified
- Dawson 1930, verified
- Baurhenn 1932, verified

At the same time, researchers were delving more deeply into this phenomenon

- Dawson and Sia, 1931, replicated the effect *in vitro*. In other words, they could see the transformation from R to S without killing mice.
- Alloway 1932, in vitro with cell debris (walls, etc.) removed by filtration.

Effect not restricted to Pneumococcal strains

- Berry and Dedrick performed similar transformation in rabbit viruses, 1936
- Berry 1937 repeated transformation *in vitro*, 1937
- These results replicated by a lot of other scholars.

Why should anyone care?

- Because making predictable and specific changes in biological traits might be handy!

So what have we done here?

We have created a concept map.

- We have a clear statement of what's not known.
- Starting at that point made it clearer what our audience needs to put this great unknown in its proper context
- Mostly, we needed to have references in place that explained the phenomenon
- Each reference contributes to different parts of the concept map in specific ways
- We also have the "so what" statement. Why should we care?

We also have all the pieces we need to create a detailed outline of a literature review![5]

Now I'm going to guess that most of you do not use outlines to write, or at least not often.

I'm also going to guess when I say the word "outline" most of you have visions of Roman numerals, capital and lower case letters, etc.

If that's what you think outlining is, I don't blame you one bit for not using them.

- Show slide of "traditional/formal" outline

Really, though, an outline is just a plan and writing with a plan helps you to clarify your thoughts and to know what kinds of evidence you need in support of your claims.

[5] Another goal I have with this lecture is to make the argument to students that they should write from outlines. I'm not sure I'm terribly successful in that goal, at least not with this lecture, but it's a start.

Can be a formal outline if that's your thing

- Diagrams
- Pictures
- Concept maps
- Whatever works for you!

But write with a plan!

Backward planning/writing[6]

Another point I want you to take home from this exercise is that all writing, and formal science writing in particular, is often easiest when you start at the end and work your way back to the beginning.

Think about the abstracts due tonight.

How many of you began writing your abstracts from the:

- Background
- Objective
- Methods
- Results
- Conclusions

That's about what I would expect. However consider your process if you had worked on you abstract from the other way around:

- Conclusions tell you
- Which results you need to justify them which, in turn
- Tells you which methods to report
- If you know what conclusions you're going to draw, writing the objective becomes simple
- That just leaves the background to give the whole thing a bit of context.

Don't get locked into linear thinking!

[6] This makes the point that many students at this point don't realize, that sometimes writing is much easier if you don't start at the beginning. At the same time, by referencing the assignment they've been wrangling for the past two weeks, this discussion gives them something concrete to refer to. Finally, it gives many students the final piece they need to complete the final drafts of the abstracts that are due the night after I deliver this lecture.

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Writing Prompt[7]

Pass out writing prompt 2

Another thing we've done with this thought experiment is to lay some of the groundwork for your next assignment.

It's really not possible to talk about assignment two without first discussing assignment three so let's begin there.

Your capstone project this semester is to write a literature review. As we've discussed, a literature review is just another name for the introduction to a paper.

A literature review serves two purposes:

- It gives background information to let the reader know what the study will be about and what we already know about the subject.
- It also highlights in very clear terms what we don't know about the subject, what we called the gap or complication last week.

If it's missing either of these, it's not a proper literature review!

The background section will be the easy part. What will be much harder is identifying what we don't know.

But that's what's due for assignment three.

Assignment two will be to plan out that literature review. For this you will be creating two documents, a memo describing your project and an annotated bibliography with at least 12 primary references:

- Write a brief, 500 word memo
- Provide an annotated bibliography
    - Reference
    - Brief summary of article
    - Statement of what role that article will play in your final literature review (background information, description of the unknown, etc.)

Finding the Unknown Exercise

Pass out first two pages of Kelly 2016 article.[8] Have students work in pairs to highlight:

- Background information (the known)
- The case for the unknown (the gap)

[7] For a copy of the writing prompt for their second major assignment, see http://hdl.handle.net/1969.1/175473.
[8] Kelly JR, Borre Y, O' Brien C, et al. Transferring the blues: depression-associated gut microbiota induces neurobehavioural changes in the rat. J Psychiatr Res. 2016;82:109-118.

Process check

If there is still significant time remaining, have students brainstorm ideas for their literature reviews.

Give them whatever time seems appropriate, but be sure to leave at least 10 minutes to close the class.

The rest of the story[9]

If time remains, tell them the outcome of the Avery, MacLeod, and McCarty story.

Following Alloway's work, they started with a cell free extract.

- Treated with proteinases—still transformed
- Treated with enzymes to break down carbohydrates—still transformed
- Treated with ribonucleases—still transformed
- Treated with DNases—no longer transformed

DNA likely the genetic material. However, remind them that it wasn't a completely definitive answer until Hershey and Chase did their work using radioisotopes.

[9] It seems only fair to let them know how this study turned out. At the same time, by walking them through the findings, I'm able to expose them, in an albeit small way, to the predictive nature of science. In other words, Avery, MacCleod, and McCarty were able to conclude that DNA was most likely the genetic material, because their experimental design predicted what results they would see after each treatment if that treatment destroyed the transformative material.